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ABSTRACT

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# Can Prospective Teachers be Autonomous Decision Makers?

**Evangelina Diaz Obando, Elizabeth M. Jakubowski and Grayson H. Wheatley**

Paper presented at the Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education

(17th PME-NA, Columbus, OH, October 21-24, 1995)

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# CAN PROSPECTIVE TEACHERS BE AUTONOMOUS DECISION MAKERS?

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The purpose of this study was to investigate the impact of a middle grades mathematics teacher preparation program on prospective teachers' practice during their internship. Using qualitative data collected from students enrolled in this course, it was found that prospective teachers during their internship displayed a great deal of autonomy in creating nontraditional learning environments and when negotiating with their supervising teachers.

Many calls (e.g., National Council of Teachers of Mathematics [NCTM], 1989; NCTM, 1991; National Research Council [NRC], 1989) to implement changes in content and pedagogy in elementary and secondary school mathematics suggest a shift from traditional practices to more student-centered activities, in which teachers become facilitators of student's learning rather than dispensers of knowledge.

Recent studies (Thompson, 1992; Brown, Cooney, and Jones, 1990) are suggesting that what teachers think about mathematics is largely influenced by their experiences long before they engage in a formal teacher preparation program. Contrastingly, Trowell and Wheatley (1994) found that college students with many years of traditional teacher-centered mathematics classroom experiences were able to negotiate rich learning environments in which problem solving, sense making, and collaboration were highly valued. It was our belief that if prospective teachers learned to become teachers in an atmosphere where they were allowed to "work at establishing a culture" in which they can negotiate meanings, explore different learning approaches, ask questions, listen to responses, and ultimately, make sense of mathematical situations in various forms then, their teaching practices can reflect the reform recommendations. Providing opportunities for prospective teachers to construct discipline specific pedagogical knowledge is one of the priorities of this project. Furthermore, we believed that participation in such a preparation program would facilitate the construction of adequate meanings for mathematical concepts as central to middle school mathematics (Jakubowski, Wheatley, Erhlich, 1993).

Previous research conducted by Shaw and Jakubowski (1991) described a model for teacher change that was used as a guide in this project not only with the prospective teachers, but also with the practicing teachers who may become role models for the prospective middle school teachers. The model includes four main constructs, "perturbation," "commitment," "vision," and "reflection" (Shaw & Jakubowski, 1991).

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Throughout the teacher preparation program a variety of activities were developed to engage prospective teachers in order to facilitate their development of a vision of a teacher. These activities were informed by a constructivist perspective under which individuals actively construct their knowledge, rather than simply absorbing ideas spoken by another person, or somehow internalizing those ideas through practice and memorization.

## Research Setting

This research is part of a larger research and development project. The aims of the project were:

1. To plan and implement courses in mathematics learning and teaching and mathematics for prospective middle school teachers based on problem-centered learning. The research group teams were created to revise or design each one of five mathematics and two mathematics education courses.

2. The development of a summer enhancement program for middle grades teachers who were also potential supervising teachers for school based experiences (e.g., Summer 1993, Summer 1994). These teachers were engaged in activities and tasks which were planned for the designed courses. The main goal of this was to engage these teachers in problem-centered learning and to provide the practicing teachers with opportunities to construct a vision of mathematics that was consistent with current calls for reform.

3. Students' participation in school-based experiences each semester prior to their student-teaching. During the last semester in the program, prospective middle school teachers are placed in middle schools for a period of fifteen weeks. An attempt is made to place them with practicing teachers who have participated in the summer program.

## Methodology

Through the use of a qualitative design, several techniques were used to collect data that depicted various perspectives. Classroom observations, interviews with interns and supervising teachers, interns' reflections, audio and video recordings of interviews and class sessions, follow up interviews, meetings with interns participating in the study constituted the data.

Analysis and interpretation of data was done to identify relevant patterns to construct a framework for communicating what data collected revealed. Data collected were analyzed on a continuous basis throughout the study. Each interview and observation was recorded in memos, field notes, and transcripts. The data were categorized according to common themes that later on were grouped. To this end, explanations were constructed by the researchers, to elucidate the actions of the participants. Triangulation of data (Guba, & Lincoln, 1989) was accomplished

by comparing data from teachers, interns, and a university supervisor to support assertions and to assure the viability of the interpretations.

## Findings

The analysis provided rich descriptions of classroom events, relationships between courses the participants had taken during their teacher preparation program, and decisions the interns made as to what to do in the classroom during their student teaching.

### Lani

Lani, is a white female in her early twenties, married with two children. Lani found herself dissatisfied in one of her early teaching sessions (at the very beginning of her internship, when she was mainly using a textbook), so she initiated negotiations with her supervising teacher about the possibility of implementing alternative teaching strategies.

She began to have students work on activities situated in a cooperative learning environment, where she organized the class into small groups and provided students with a task so that students could discuss it in their small groups and attempt to make sense of the task. An example of that occurred when she was teaching a unit on fractions. Planning to use tangram sets to help students make sense of fractions in a meaningful way (mathematically speaking). She decided to have students construct their own tangram sets. Lani's main rationale was that by having students construct their own set, they would become more familiar with the different shapes in the set and with different relationships of the pieces. Therefore, when they later used their tangram sets to solve fraction problems, students' explanations would be more meaningful to them. It seems that Lani had the students' understanding of mathematics and student's enjoyment of mathematics as a primary goal of her teaching. The supervising teacher expressed repeatedly [e.g., bi-weekly evaluations, interviews], "Lani continues to establish a classroom environment that is conducive to learning. She engages students in a variety of meaningful learning activities...she has also incorporated other methods of teaching in her lessons...all activities thus far encourage students to construct their own knowledge...through discussion she constantly encourages students to reflect on their own knowledge...I am impressed with the meaningful activities which she has either made or found."

Uncharacteristic of interns, Lani organized a grade level activity she had developed and called a "A Pi Day." This required her to obtain the cooperation of other teachers on her team. In this activity students could submit 3-Dimensional shapes, a poster, a tessellation, and/or a mathematical puzzle. This activity was characterized by other school teachers, judges, and students as a huge success.

### Andy

Andy, a white male in his early twenties, was a Mechanical Engineering major for two years prior to becoming a prospective middle school mathematics teacher.

He had done volunteer coaching of track and wrestling to middle school students. For his student teaching he was placed at a middle school with a teacher who had been involved in the project.

From observations of his classes it was evident that Andy cared a great deal about students' learning. Similarly to Lani, Andy had initiated negotiations with his supervising teacher in an attempt to implement alternative teaching strategies. His supervising teacher expressed the following, "I see great potential in his instructional methodologies. I like that he takes initiative, and my desire is that this internship will be a great learning experience for him." In another interview she said, "He is not relying on me, he has his things that he is trying to do (in his classroom), and I think that is coming from the middle school program [Andy's autonomy to initiate or to suggest ideas he wanted to implement in the classroom], what I do is to ask him to show me beforehand his ideas on what he plans to teach, for specific concepts...; He is very secure that I am going to support him. I may not agree with what he is doing, but I'm not going to tell him "no." I'll let him make his own decisions." The teacher's ways of describing Andy's style of planning and teaching was an indication of his confidence and initiative; because of his preparation, he was able to formulate effective learning environments for his students.

For example, on several occasions, during his teaching, Andy took students outdoors to conduct mathematics learning activities. He provided meaningful learning environments for students by using a variety of settings and materials. Also, Andy enriched his teaching by using segments of videotapes (e.g., "The Alhambra Past and Present: A Geometer's Odyssey," and "The Story of Pi"), manipulatives, and laser disks (from The Jasper Woodbury Series) as a way to facilitate students' understanding of the mathematical concepts being studied. When additional resources, not available at the school, were needed, he went to the Mathematics Education Department to get them.

Andy's style of teaching focused on developing connections between mathematical concepts and real-life situations. He said that students at middle school have so much potential that it would be a shame not to take advantage of it to bring mathematics into their real world. He also said, "If I don't enjoy teaching everyday in some manner I will convey this attitude to my students." This attitude typified most of Andy's actions in his classes. The creation of trust between teacher and students and connecting mathematics to real life situations were the foundation for Andy's teaching practices.

### Kathy

Kathy is a white female in her early twenties that was about to get married. She believed that she could make special contributions to middle grade students because she is patient, caring and a good listener. It was evident during her interactions with students.

During their teacher preparation courses, Kathy, unlike the other two participants, was not as active in the classroom as Lani and Andy were. Nevertheless,

Kathy was very involved in the program and her ideas were sharp and insightful. Kathy was not placed in a local middle school [for personal reasons] and therefore was with a supervising teacher who was not engaged in the middle school project and who Kathy did not already know.

While Kathy was quiet and more passive than Lani and Andy, she took initiatives in planning sessions with her supervising teacher. She prepared some activities before meeting with her supervising teacher, so that during planning time she could propose those activities as well as alternative instructional strategies such as small group problem solving. She also believed the main role of the teacher was to make sure that students understand the concepts being taught during class time. Hence, she used manipulatives to facilitate her students' learning.

She was very good at providing students with assistance, and during class discussions she usually allowed two or three students to share their approach to solving a problem. In fact, her area coordinator supervisor was very impressed with the type of questions that she asked, such as "how did you get it?," "could you explain how you constructed that shape?," or "what is another way to solve this problem?" These types of questions evidenced that Kathy was not only interested in an answer, but that she was very concerned about the process that would tell her how specific students were making sense of a situation. Accordingly, the learning atmospheres she created with her students were conducive to students' learning.

Kathy also initiated the use of personal mathematics folders. It included materials given and/or constructed by students that were relevant to the topic they were studying and students' definitions of the new terminology. She agreed with her supervising teacher that because of the additional work it represented, she would implement this folder only in one group. Her rationale for the inclusion of this activity was that students at middle school age needed to develop a sense of responsibility and to become more organized. This rationale was consistent with her philosophy of teaching in which she had emphasized the importance of providing students with opportunities to become decision makers. Kathy had been asked to keep such folders in her preservice courses.

Her supervising teacher was touched by Kathy's attitude toward teaching and highlighted Kathy's attributes as a beginning teacher by stating, "I have had many student teachers [from other universities] but Kathy is the best intern I have had so far. On a scale from one to five, I would give Kathy a five."

## Conclusions

In this study we have learned that the experiences that Lani, Andy and Kathy have had during their teacher preparation program have been beneficial in helping them to develop images for the creation of learning environments where students could learn mathematics meaningfully. It was possible to trace many of their actions directly to their university experiences. Thus participation in this project did influence these prospective teachers since they all showed initiative in both their teaching practice and in negotiating with their supervising teacher during planning time.

From the participating prospective teachers' experiences we observed the potential for prospective teachers to become autonomous through participation in a preparation program similar to the one described herein. However, it remains to be seen whether this group of prospective teachers will be autonomous when they begin teaching professionally and no longer have the support of the middle school project or supervising teacher.

The summer program for middle school teachers helped them be more effective as supervising teachers by not only being receptive to innovative practices suggested by interns but by helping them develop successful lessons. Having teachers who share a vision of mathematics learning with the university mathematics education faculty is a crucial element in effective teacher preparation.

In summary, we found evidence that these interns were becoming "emancipated teachers" (as described by Grundy, 1987) who were eager to create alternative learning environments in their classrooms. When the conditions are provided and prospective teachers have had experiences consistent with those suggested by reform calls, we witnessed evidences that prospective teachers can be autonomous decision makers as suggested by curricular reform documents.

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